ARTIFICIAL DRYING OF FARM CROPS IN THE UNITED STATES

A Selected Bibliography

Compiled
by
Dorothy W. Graf, Librarian

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American Process Dryer. Manufactured by the American Process Company, 55 Park Place, N.Y. Rotary kiln type. Air is mixed with furnace gases before coming in contact with material to be dried. Installation on farm of Walker-Gordon Laboratory Company, Juliustown, N.J., used for drying manure, alfalfa and corn fodder.

Ardrier. Manufactured by Arnold Dryer Company, 1200 Montana Ave., Milwaukee, Wisconsin. Rotary drum type consisting of three drums, one within the other. Stationery or portable. Coal or oil burning. Capacity approximately one tone dried hay per hour. Drying is accomplished by means of undiluted furnace gases at a temperature of about 1500 degrees F. The hay remains in the dryer from 30 seconds to 6 minutes. Power requirements approximately 30 horsepower not including chopping. Installation on farm of G.D. Arnold, Galesville, Wis., used for drying alfalfa and by products from canning factories.

Bayley Forage Dryer. Manufactured by the Bayley Blower Company, 732-750 Greenbush Street, Milwaukee, Wisconsin. Conveyor type with tunnel 150' long and 10' wide. Coal or oil burning. Built either with open or closed tunnel. Open type uses mixture of air and furnace gases while the closed type used the undiluted furnace gases. In the former type the mixture enters dryer at a temperature of approximately 250 degrees F. Capacity about 1 1/2 tons of dried hay per hour with power requirement of 60 h.p. not including grinding. Forage remains in drier about 30 minutes. Used for drying alfalfa and hemp. Two tunnel-installation on farm of Ward Mooring, Bryan, Texas.

Food Machinery Corporation. San Jose, California. This process consists in crushing the stems of the alfalfa as it is mowed with purpose of hastening the drying of the stems so that they may be sun-cured in approximately the same time as it takes to dry the leaves.

Fulmer Dryer. Built by the Fulmer Alfalfa Dryer Company, Nazareth, Pennsylvania. Conveyor type with tunnel approximately 200' long, built of cinder concrete block. Capacity about 2 tons of dried hay per hour. Power requirements about 58 h.p. not including grinding. Hay remains in dryer about 45 minutes. Installation on Green Acres Farm, owned by J.H. Fulmer, Nazareth, Pennsylvania.

Koon Dryer. Manufactured by A.W. Koon Process Company, New Orleans, Louisiana. This dryer uses the undiluted gases from a furnace at about 1,000 degrees F. as a drying medium. The material to be dried is first cut with an ensilage cutter and then blown through insulated piping in contact with the hot gases. Six fans are used. A considerable amount of the gases are recirculated through the furnace. Capacity about 1 1/2 tons of dried hay per hour. Power requirements are about 150 h.p. not including grinding. The hay passes through the dryer in about 1 minute. Installations on farm of A. Montz, La Place, Louisiana. Used for drying alfalfa, clover, peas, oats, rye and soybeans.

Louisiana State University.
Experiment dryer. Rotary drum type. Drum approximately 40' long and 6' in diameter. Oil burning. The hot combustion gases enter the dryer at about 1,600 degrees F. with little or no air. Capacity approximately one ton of dried alfalfa per hour. Power requirements approximately 6 h.p. not including chopping or grinding. Installation at the Louisiana State University Agricultural Experiment Station, Baton Rouge, Louisiana. Used for drying alfalfa and soybeans.

Louisville Dryer. Manufactured by Louisville Drying Machine Company, Louisville, Kentucky. Rotary drum type. Consists of a long rotating drum onto one end of which is mounted concentrically, a short drum of larger diameter. Slots in the larger drum permit the hot gases from the surrounding furnace to contact the inner drum and pass latterally into the other portion of the long drum. Flights within the short and remainder of long drum tend to keep the material being dried in suspension. The forage is introduced into the short drum by means of a screw conveyor.

Mason Dryer. Manufactured by Mason Alfalfa Process Company, 1520 Locust Street, Philadelphia, Pennsylvania. Conveyor type, tunnel 150' long by 9' wide. Special ribbon forming mechanism places material in uniform thickness upon the conveyor. A mixture of furnace gas and air enters the dryer at a temperature of approximately 275 degrees F. The hay remains in the dryer for about 30 minutes. Capacity about 2 tons of dried hay per hour. Power requirements approximately 70 h.p. not including grinding. Installations on farms of Walker-Gordon Laboratory Company, Plainsboro, New Jersey. The company operates a plant near New Castle, Delaware. Used for drying alfalfa, soybeans, wheat, rye, oats, etc.

Proctor Alfalfa Dryer. Manufactured by Proctor and Schwartz, Inc., Seventh Street and Tabor Road, Philadelphia, Pennsylvania. In principle this machine is a two stage single apron dryer in which the alfalfa, cut into 3" lengths, is deposited by an automatic feeder onto the first stage apron where it is partly dried, after which it is thoroughly agitated and redeposited on the apron of the second stage dryer. The heat is supplied to this machine by an anthracite coal burning furnace and is delivered to a duct below the conveyors by a large blower fan. The temperature controls are arranged to control the temperature at approximately 285 degrees F. at the entering end and 225 to 250 degrees F. at the delivery end.

Purdue University.

Experimental Dryer. Tray type portable. Alfalfa is blown from ensilage cutter to tank which has double bottom into which hot air is blown.

Randolph Drier. Manufactured by the O.W. Randolph Company, Toledo, Ohio. Tray type. Dryer consists of compartment which accommodates 6 trays at one time, placed one above the other. The trays containing the wet hay enter at the top and the pans containing the dried hay are removed at the bottom. A mixture of air and furnace gases enters the dryer at a temperature of about 230 degrees F. Temperature control is automatic. Installation at the Pennsylvania State College, Agricultural Experiment Station, State College, Pennsylvania.

Stearns-Roger Dryer. Manufactured by Stearns-Roger Manufacturing Company, Denver, Colorado. This dryer is suitable principally for food wastes or vegetable products containing high moistures and has been extensively used for the drying of beet pulp.

The alfalfa dryer is different from the beet pulp dryer only at the discharge end where the dried material is blown by the fan in the case of alfalfa and similar products, whereas with beet pulp the material and the air is separated and only the air goes thru the fan. A brief description of our alfalfa dryer is as follows: The furnace for the gas or oil firing is a self-contained unit of ample capacity and the amount of fuel is automatically controlled by the temperature at the discharge end of the dryer. The dryer shell is a single pass unit, the material being conveyed thru the shell by the air stream produced by the fan, so that the dried material is automatically removed when of the proper dryness. The dryer shell is

Stearns-Roger Dryer. (Cont'd.) constructed with specially arranged baffles in the interior so that each particle is subject to the warm air. The temperature at the inlet of the dryer can be regulated to the desired degree, and the temperature at the outlet is automatically controlled so that it will remain constant at any predetermined degree desired. The whole dryer is designed for out-door installation so that no housing is necessary. Where it is necessary to cool the dried material such as in making alfalfa meal, a second fan and dust collector unit can be installed.

Whirlwind Dryer. Maryland Dryer Machinery Company, 635 Baltimore Trust Building, Baltimore, Maryland. Consists essentially of stationary horizontal drum 30' long x 36" diameter and appurtenances. A whirlwind effect inside of the dryer cylinder (drum) is caused by means of a rapidly revolving agitator operating in the air stream, and through the suction of the fan used for exhausting the gases and dried material from the cylinder.

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APPARATUS.

See also each crop.

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to plant without intermediate manual handling, first passes through set of crushing and chopping gears, which masticate it, and at same time prevent intrusion of free moisture to next stage of process. These gears are of "herring bone" design, with special teeth which shear grass and press it gently but firmly between tops and bottoms of alternate teeth, helical tooth angle allowing moisture to flow laterally, while "line" contact prevents free moisture from passing forward between teeth to delivery side of gears. Crushing action is positive, without rubbing, and designed not to damage grass, so retaining as many of ingredients as possible. From gears, grass is spread evenly upon mesh conveyor, which carries it through pre-heating chamber. Here, exhausted drying steam and large additional volume of steam created by evaporation are brought from drying chamber proper to scrub cold grass thoroughly and, by condensing upon it, raise its temperature. Hot grass and condensate then enter second crusher, where, with gears of same design, it goes through similar process to that experienced on first occasion. Thence it is spread on conveyor and carried through drier proper. Super-heated steam is blown in below this conveyor and passing through grass, agitates and dries it. Particles of crushed grass are blown upwards, while any lumps from crusher pass against rotary tedder, which "teasels" them out and throws them back down the conveyor. Blast escapes upwards and carries with it particles of dried and semi-dried grass. But in path of blast a second conveyor is interposed, on underside of which particles of grass are deposited and supported by blast, thus forming an "inverted mattress" in path of super-heated steam. Mattress is broken up by being blown over end of conveyor into upper chamber, but as blast is of lesser intensity here, upper and lower surfaces of both conveyors are used to move grass towards the exit. Before grass finally falls by gravity into chute, however, it has to pass control area, whose object is to ensure fully dried product.

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Operation of the mechanical dryer (Ardrier). Vermont. Agricultural experiment station. Bulletin no.380. Burlington, Vermont, 1934. p.16. The amounts of product dried for experimental purposes are too limited to develop definite cost data applicable to practical commercial conditions. However, results from several short runs yielding 43 tons of dry material are given.

Weight of green material	206,780 pounds.
Weight of dry material	86,182 pounds.
Yield of dry material	4.7 pounds.
Operating time	82.5 hours.
Water evaporated per hour	1,462 pounds.
Oil required per ton dry hay	43.6 gallons.
Cost of oil per ton dry hay at $.07	$3.05
Electricity used for cutter and dryer	22 kwh.
Cost of electricity per ton dry hay at $.03	$0.66
Time to process 1 ton dry material	1.9 hours.
Labor cost, 2 men at $.30 per hour	$1.14

Cost of heat, power and labor per ton of dry material..... $4.85
Cost of heat, power and labor per ton of water evaporated..... $3.48

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(Hops, Seeds, Copra)

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AUTHOR INDEX.